



CAPITAL AREA TRANSPORTATION AUTHORITY

NATHAN TRIPLETT, **Board Chair** BRADLEY T. FUNKHOUSER, AICP, **Chief Executive Officer**

\$8 Million Michigan Mobility Challenge

LookingBus Final Project Evaluation

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Project Background

The \$8 Million Michigan Mobility Challenge shed light on an opportunity to provide an improved public transportation experience for people with disabilities, specifically persons with visual impairments living in the Lansing, East Lansing, and Meridian Township areas.

Project Background

Our vision was to provide a system that improved travel safety and convenience for visually impaired and mobility-challenged customers. The goal of this pilot system was to shift the demand from more expensive paratransit service to lower-cost fixed-route services, while also enhancing overall customer experience.

Project Background

With the proposed system, visually impaired and mobility-challenged customers would have the freedom and flexibility to independently ride CATA's fixed-route bus system, removing any scheduling limitations a customer might encounter when arranging for paratransit service.

Pilot Project Intent

The intent was to provide visually impaired customers with an iOS and Android smartphone application that would provide door-to-door walking directions, enhancing the experience within CATA's regularly scheduled fixed-route bus service.

Pilot Project Intent

The customer's smartphone application would connect with an on-board bus application, alerting the driver of an upcoming stop requested by a visually impaired customer. The driver would have knowledge of the upcoming customer stop, enabling the driver to prepare for and provide this specialized service.

Third-Party Information

LookingBus Proprietary Information 2021

CATA began working with [LookingBus](#), a third-party vendor located in Ann Arbor, Mich. LookingBus proposed utilizing a system of hardware and software that would enable customers to independently ride CATA's fixed-route bus system.

Third-Party Information

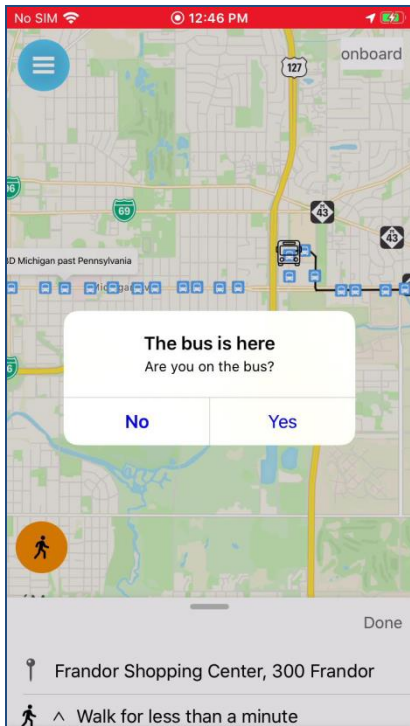
LookingBus Proprietary Information 2021

The LookingBus research objective was to deploy a Smart City service, which was comprised of four system components:

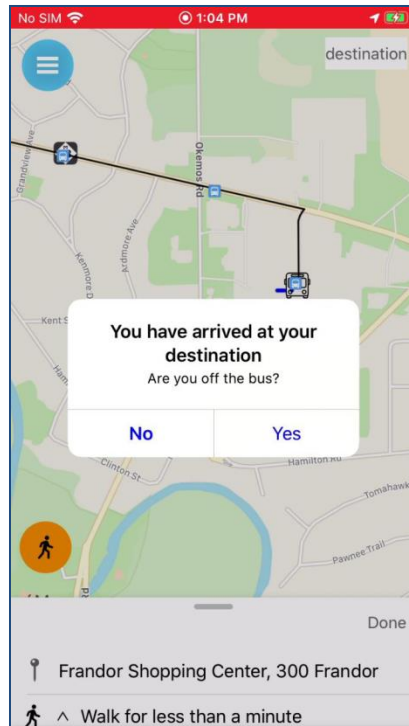
Components	Physical Units
1. User application	Android and iOS apps
2. Driver Alerting Unit	Tablet mounted on bus
3. Smart Stop	Sensors at bus stops
4. Monitoring Computer-Aided Dispatch	Operations web browser

Third-Party Information

LookingBus Proprietary Information 2021



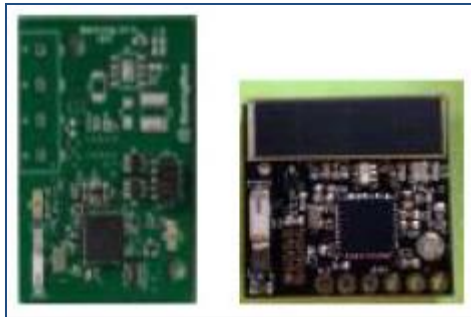
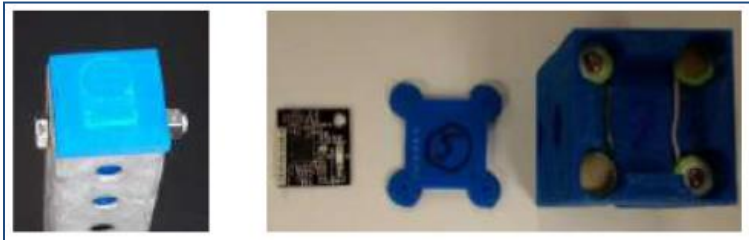
iOS User Application Example



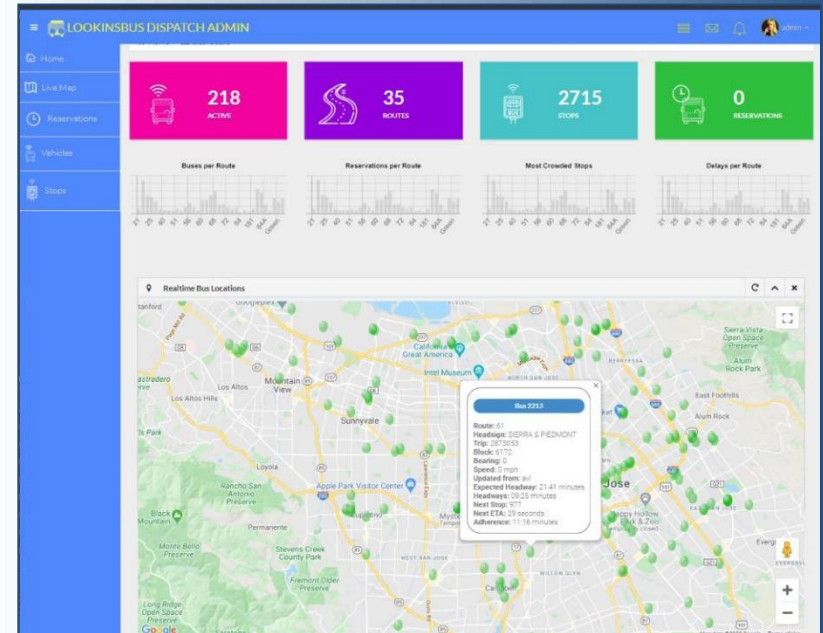
Driver Alerting Unit and On-Board Unit Prototype

Third-Party Information

LookingBus Proprietary Information 2021



Smart Stop Sensor Prototype
(also referred to as Roadside Units)



Computer-Aided Dispatch (CAD)
Example

Third-Party Information

LookingBus Proprietary Information 2021

Schematics of the LookingBus System:

Bus stop sensors, driver device, and a mobile application would work in synchrony to ensure that drivers are aware of customers within the vicinity of the bus stop and of the destinations of customers on their buses.

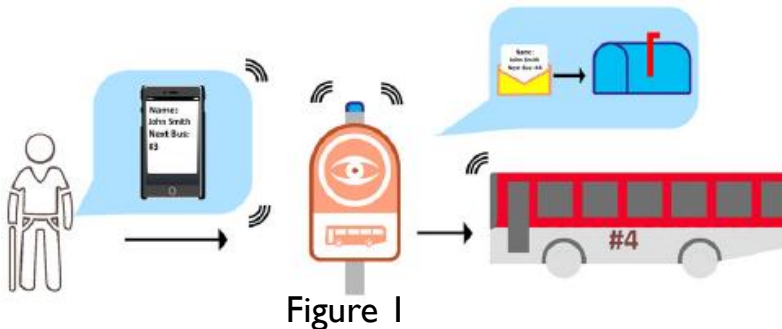


Figure 1 – Getting on the Bus: As customer approaches bus stop, a message is sent from a user's phone and is stored in a smart sensor on the bus stop where it is then relayed to relevant bus drivers. After a ride reservation is placed by the customer, the sensor will send an advanced notice to the driver that a customer is waiting at the stop.

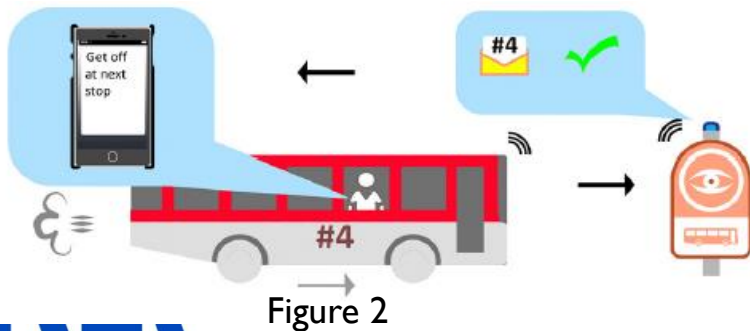


Figure 2 – Getting off the Bus: Toward the end of the ride, system alerts both bus driver and customer about the destination stop ahead.

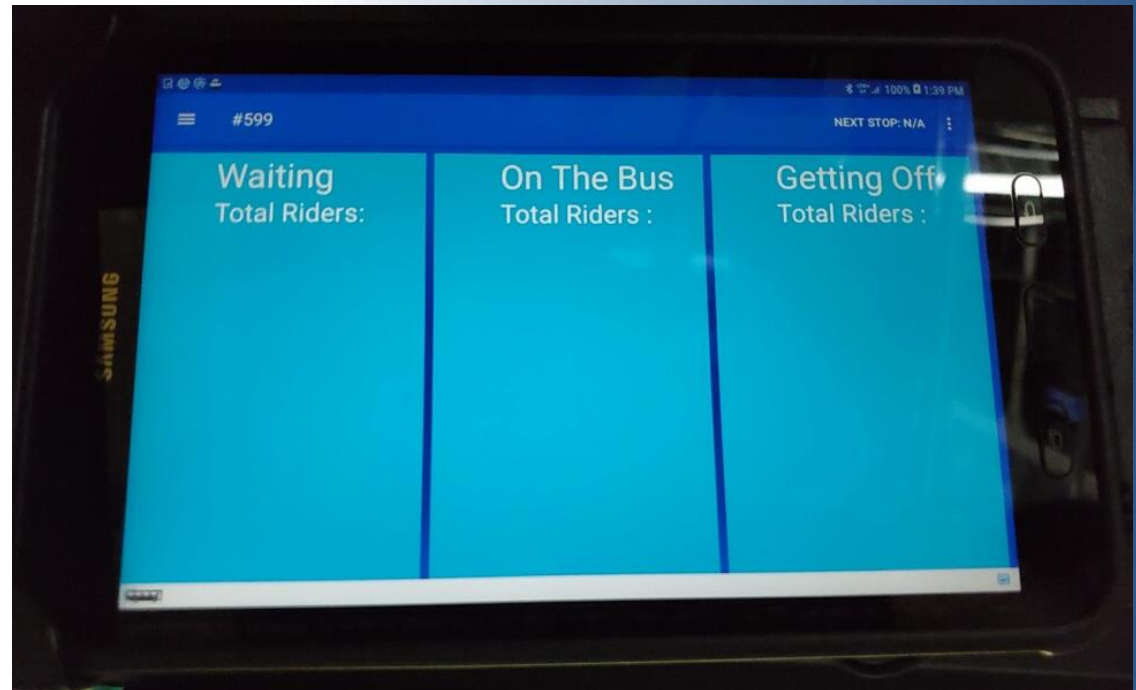
Testing of System

In working with LookingBus, CATA identified 10 main objectives that would guide testing.

1. Customer makes a reservation using the application
2. Customer receives walking directions to bus stop
3. Driver receives reservation on Driver Alerting Unit (tablet)
4. Reservation verified through CAD display
5. Customer confirms boarding on bus
6. Driver confirms boarding on bus
7. Notification sent to customer of impending deboarding stop
8. Notification sent to driver of impending customer deboarding
9. Customer verifies deboarding
10. Driver verifies deboarding

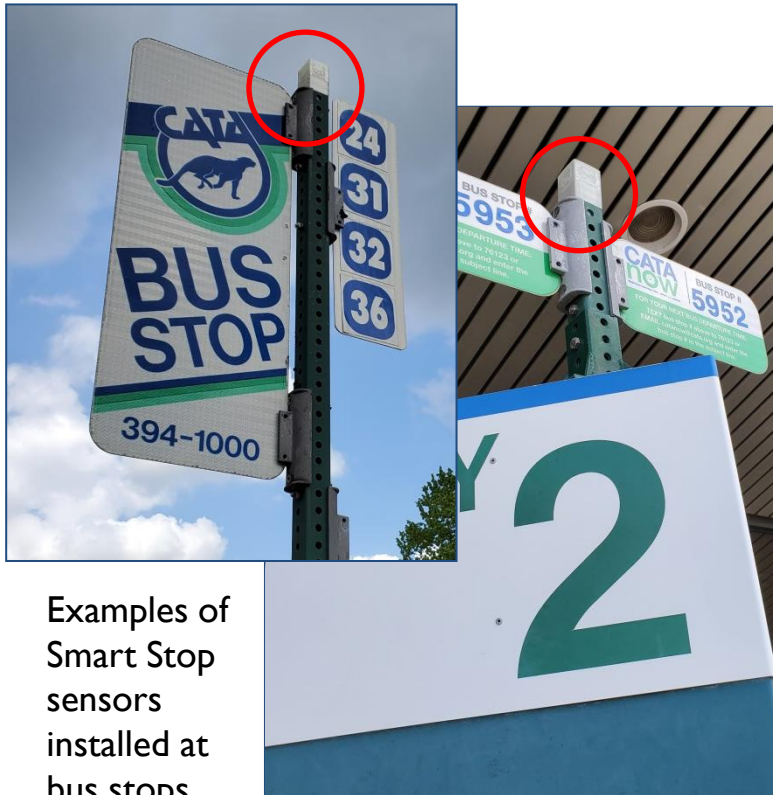
Testing of System

To test the LookingBus system, CATA mounted 125 tablets on buses. These tablets were installed with the LookingBus Driver Alerting Unit software.



Example of tablet mounted on CATA bus displaying Driver Alerting Unit software.

Testing of System



Examples of Smart Stop sensors installed at bus stops.

Additionally, CATA procured 236 Smart Stop sensors from LookingBus and installed them on the bus stops that were identified as key routes for this pilot project.

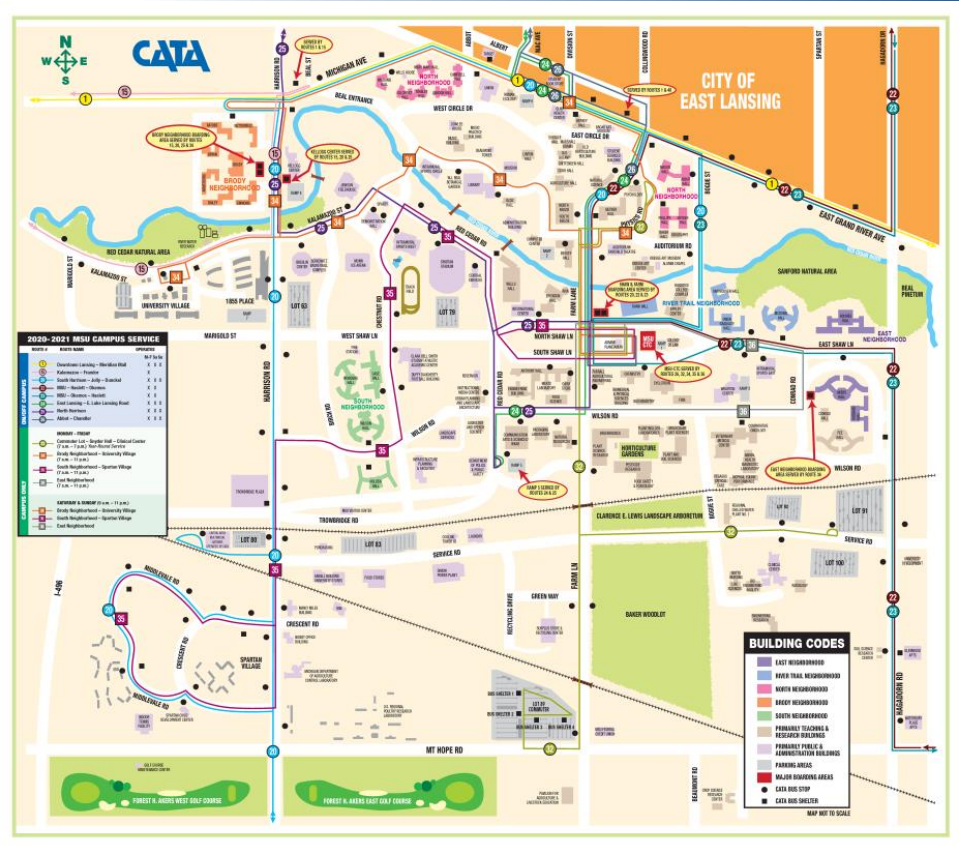
Testing of System

The pilot routes were chosen based on frequency of buses, trip complexity (multi-route trips), and high ridership patterns.

- **Route 1** – East-to-west core route; covers a large service area
- **Route 24** – North-to-south route with connection point to Route 1
- **Routes 30-36,38,39** – MSU campus routes with high frequency

Testing of System

Using the established pilot routes, CATA set out to test the LookingBus system. Real-life single-ride and two-ride trip scenarios were created.



Map of 2021-2022 MSU Campus service.

Testing of System

Single-Ride Trip Scenarios:

Scenario	Route	Origin	Destination
1	1	Frاندور, 300 N Clippert Street, Suite 18, Lansing	Meijer Okemos
2	24	547 E Circle Drive, East Lansing	3054 E Lake Lansing Road, East Lansing
3	30	755 Science Road, East Lansing	Akers Hall MSU, East Lansing
4	30	619 Red Cedar Road, East Lansing	Ramp 1 MSU, East Lansing
5	31	366 W Circle Drive, East Lansing	755 Science Road, East Lansing
6	31	755 Science Road, East Lansing	Akers Hall MSU, East Lansing
7	33	474 S Shaw Lane, East Lansing	542 Auditorium Road, East Lansing
8	33	366 W Circle Drive, East Lansing	755 Science Road, East Lansing

Two-Ride Trip Scenarios:

Scenario	Route	Origin	Destination
9	1 & 2	Frاندور, 300 N Clippert Street, Suite 18, Lansing	3054 E Lake Lansing Road, East Lansing
10	24 & 1	3054 E Lake Lansing Road, East Lansing	Frاندور, 300 N Clippert Street, Suite 18, Lansing

Testing Conclusion

CATA and LookingBus conducted independent testing of both user and driver applications, with testing done virtually by LookingBus and in the field by CATA. The two testing methods resulted in individual differences, culminating in separate conclusions.

Subsequent information will provide final test results from CATA and LookingBus, based on the last user application release, dated May 21, 2021.

Testing Conclusion

CATA Final Testing Results:

Testing Criteria	Results Summary
Customer makes reservation	Reservation frequently secured
Customer receives walking directions	Still in development, results inconsistent
Driver receives reservation	Reservation frequently secured
Reservation verified through CAD	Reservation frequently secured
Customer confirms boarding	Confirmation results varied
Driver confirms boarding	Functionality not tested
Customer notified of impending deboarding	Notification frequently alerted
Driver notified of impending deboarding	Notification frequently alerted
Customer verifies deboarding	Confirmation results varied
Driver verifies deboarding	Functionality not tested

Testing Conclusion

CATA Final Testing Results – Additional Info:

1. Customer Makes Reservation

Successful reservations are dependent on reliable communication between multiple technology systems. In order to make a reservation, on-board Automatic Vehicle Location (AVL), CATA servers, and LookingBus system all require constant communication. Interruptions in any of the systems can lead to a reservation not being made. When these systems are all working in conjunction, reservations were frequently successful; however, users reported intermittent outages while trying to make a reservation.

Testing revealed that suggested route reservations could lead to confusion. The initial route suggestion was not always able to provide the most efficient trip for the user. Suggested reservations often instructed the user to walk great distances when an alternative route could reduce travel time. The ability to have a more intuitive trip selection is still in development.

2. Customer Receives Walking Directions

Users reported audible walking directions were inaccurate and unclear. The audible announcements did not correspond with the visual aide within the application. Users often found that the notification, due to technology limitations, did not provide timely updates to their direction of travel, limiting the application's ability to direct the user to a desired location. Users also reported that the visual aide within the application did not always maintain the travel path on the sidewalk. These features are still in development.

Testing Conclusion

CATA Final Testing Results – Additional Info (Continued):

3. Driver Receives Reservation

The ability for the driver to receive a successful reservation relies on connectivity between the LookingBus system and onboard bus tablets. Over the course of this project, there were ongoing issues with stability related to the user application and tablets. Application crashes and tablet failures could result in a driver not receiving a reservation alert. When both the tablet and user application were running and connected, the driver received successful reservations.

4. Reservation Verified Through CAD

The CAD system provided information pertaining to active and completed reservations, as well as real-time tracking of fixed-route buses. Successful reservations were consistently verified through the CAD system during testing.

5. Customer Confirms Boarding

Due to technical limitations, bus arrival notifications are delayed which can result in the user missing the bus. Communication between the bus and user application can be delayed by up to 60 seconds. Users experienced this delay consistently during testing.

Testing Conclusion

CATA Final Testing Results – Additional Info (Continued):

6. Driver Confirms Boarding

Driver confirmation was removed from the driver application due to possible distractions that may result from physical interaction with the tablet.

7. Customer Notified of Deboarding

The user application consistently provided audible notifications of the upcoming stop.

8. Driver Notified of Deboarding

The driver application is designed to display the active reservations, along with the current status of the user's trip. When the user is set to deboard the bus, the status is updated to notify the driver of the request to deboard. With each successful reservation, the driver application consistently notified the driver of the pending deboarding.

9. Customer Verifies Deboarding

Once the user reaches the destination bus stop, the application consistently prompted the user to confirm deboarding.

10. Driver Verifies Deboarding

Driver confirmation was removed from the driver application due to possible distractions that may result from physical interaction with the tablet.

Budget Breakdown

Expenditures and deobligated funds for this project are detailed below.

Initial Award Amount	\$464,910
LookingBus Software	\$245,000
LookingBus Hardware	\$70,800
Additional Hardware	\$74,625
Project Labor	\$775
Deobligated Funds (Budgeted for marketing and training materials; not expended as system was not implemented.)	\$73,710

Project Conclusion

The initial project intent – to provide CATA’s visually impaired customers with an iOS and Android smartphone application that would provide door-to-door walking directions – was kept at the forefront throughout testing.

Although some key elements of the LookingBus system functioned consistently, a ready-to-use system is still in development.

Project Conclusion

The LookingBus application was not released to CATA's Local Advisory Committee (LAC) or any other group for User Acceptance Testing. The primary reasons for this course of action was the instability and safety implications of the walking directions. The LookingBus team advised that, although an application with fully functioning walking directions is still being developed within the app market and is not expected to be released until 2022 or after, they will continue to independently work on applications.

Lessons Learned

The need for a technological solution that enables visually impaired customers the opportunity to ride CATA's fixed-route system is still a highly sought-after need. As CATA continues to provide transportation solutions to the capital city region, the following key takeaways will be considered and applied to any future projects that endeavor to reach this goal.

Lessons Learned

Key Take-Aways:

- **Increase Vendor Requirements** – Request information on previous partnerships, conducting independent research when deemed appropriate. Request an in-depth product demo, inquire about previous testing successes and failures, if applicable.
- **Establish Realistic Timelines** – Technology needed for this system is still in development. A longer project timeline might have helped in achieving a final product.
- **Assess Community Need** – Pursue other funding sources that could provide an opportunity to fill this need.



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